Ecological Restoration Institute

Fact Sheet: Increasing Evidence That Thinning and Burning Treatments Help Restore Understory Plant Communities in Ponderosa Pine Forests

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Introduction

There is a general consensus that throughout their range, contemporary ponderosa pine forests exist outside of their natural range of variability in terms of overstory structure such as tree density (trees ac^{-1}) and basal area (ft^2 ac^{-1}). As a result these ecosystems are increasingly susceptible to landscape-scale, high-intensity wildfires. Over the last century, a number of factors—particularly intensive livestock grazing, selective logging, and fire suppression—have combined to favor pine establishment at the expense of understory diversity and productivity. This has given rise to uncharacteristically high tree densities with closed canopies, lower light availability, and deeper forest floor litter and duff layers (Covington and Moore 1994). A major consequence of this has been the degradation of understory integrity, including declines in understory cover, productivity, and diversity.

Restoration techniques for mitigating these changes include mechanical thinning, prescribed fire, or a combination of the two. Empirical studies assessing treatment success have shown that a combination of mechanical thinning plus prescribed fire is most successful at reaching overstory restoration targets (Fulé et al. 2002; Roccaforte et al. 2015). Yet consensus on meeting understory objectives remains mixed and few studies have defined quantitative targets to assess understory response (Laughlin et al. 2006). Therefore, developing more specific restoration objectives for the understory plant community represents an under-developed and challenging area of research. However, a primary goal of ecological restoration for understory plant response following treatments is to maximize cover and diversity of native vegetation.

Our first objective in this study was to evaluated understory response to alternative restoration treatments. We measured understory cover and species richness five years after treatments in the Mineral Ecosystem Management Area (Mineral) located in east-central Arizona and part of the Ecological Restoration Institute's Long-term Ecological Assessment and Restoration Network (LEARN). An untreated control (Untreated) was used for comparison of two alternative restoration treatments 1) thinning followed by prescribed fire (Thin + Burn) and 2) prescribed fire only (Burn-only). Our second objective was to compare the understory response patterns we observed at Mineral with those following similar treatments at other LEARN sites. To make comparisons we quantified a range of variability associated with understory cover and species richness to restoration using three comparison LEARN sites located in ponderosa pine forests of northern Arizona: Fort Valley (FV), Mount Trumbull (MT), and Grandview (GV). All three sites are located across a gradient of precipitation and soil types, representing a broad range of ponderosa pine forest types with characteristic differences in the contribution of species and functional groups to understory cover and diversity.

Research Findings

Understory community response at Mineral site

- Five years post-treatment understory cover and species richness were significantly greater in Thin + Burn compared to Untreated units. Burn-only treatments were less successful in meeting this objective.
- Average species richness increased 33%, 36%, and 45% in Untreated, Burn-only, and Thin + Burn treatment units, respectively.

- Total graminoid cover was significantly greater in Thin + Burn treatments compared to Burn-only or Untreated units.
- Total forb cover was significantly higher in Thin + Burn relative to Untreated units.
- Burn-only treatments were successful at increasing the number of annual-biennial species. However, this increase was not as great as that observed in the Thin + Burn units.

Comparison across LEARN sites

- The increase in species richness values in Thin + Burn units at Mineral exceeded those observed in similar treatments at other LEARN sites.
- There was a consistent increase in total and native plant cover after Thin + Burn treatments across the LEARN sites (Figure 1).
- Total plant cover five years after Thin + Burn treatments ranged from an average of 7.2% to 13.1% across LEARN sites. Total plant cover in the full restoration treatments at Mineral fell within this range.
- Native plant cover across LEARN sites ranged from 6.1% to 9.2%. Average native plant cover in Thin + Burn at Mineral fell just above these values, at 9.6%.

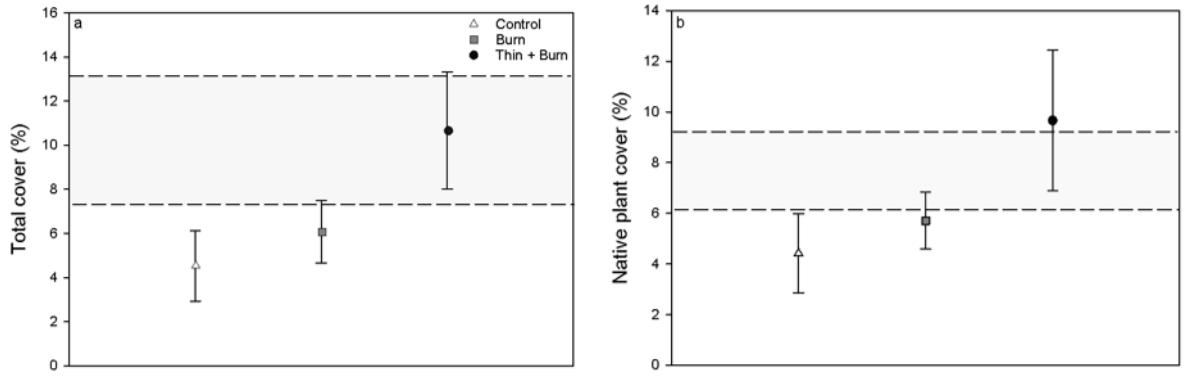

***Figure 1**. Average total (a) and native (b) species cover five years post-treatment (2013) at Mineral relative to the range of variability across three LEARN sites. Dashed lines represent the lower and upper average values from across three LEARN sites.*

Conclusions

- Managers can expect understory plant communities to respond positively following restoration treatments that combined mechanical thinning and prescribed fire.
- This study suggests that for understory cover, defining more specific goals and objectives to assess restoration success is realistic.
- The LEARN provided a valuable opportunity to combine data from within an ecological system, across different sites, to compare and evaluate the consistency of responses.

Literature Cited

Covington, W.W., and M.M. Moore. 1994. Post-settlement changes in natural fire regimes and forest structure: ecological restoration of old-growth pine forests. *Journal of Sustainable Forestry* 2:153-181.

Fulé, P.Z. W.W. Covington, H.B. Smith, J.D. Springer, T.A. Heinlein, K.D. Huisinga, and M.M. Moore. 2002. Comparing ecological restoration alternatives: Grand Canyon, Arizona. *Forest Ecology and Management* 170:19-41.

Laughlin, D.C., M.M. Moore, J.D. Bakker, C.A. Casey, J.D. Springer, P.Z. Fulé, and W.W. Covington. 2006. Assessing targets for the restoration of herbaceous vegetation in ponderosa pine forests. *Restoration Ecology* 14:548-560.

Roccaforte, J.P., D.W. Huffman, P.Z. Fulé, W.W. Covington, W.W. Chancellor, M.T. Stoddard, J.E. Crouse. 2015. Forest structure and fuels dynamics following ponderosa pine restoration treatments, White Mountains, Arizona, USA. *Forest Ecology and Management* 337:174-185.

This fact sheet summarizes information from the following publication:

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